



## SDC SOLENOID DESIGN NOTE #191

TITLE:       Stability of Two-phase Helium Cooling in Deep Underground Experiments

AUTHOR:     T. Haruyama (KEK)

DATE:        Dec. 10, 1992

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This design note is one of a series which represents the proceedings of the SDC solenoid subgroup meeting held in Japan on December 8-11, 1992. The plan and purpose of the meeting was to:

- Look at the prototype coil winding and honeycomb vessel R&D in Japan
- Reports of technical progress from each group
- Plan and schedule for the prototype magnet assembly and test
- Discussions on design of the SDC solenoid power supply
- Discussions on cryogenic design for the SDC solenoid
- Discussions on responsibilities for the cryogenics fabrication
- Response to the report of the DOE review sub-committee
- Publications and presentations of the technical progress

**SDC Solenoid Subgroup Meeting in Japan**

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**Stability of 2 Phase Helium Cooling in Deep  
Underground**

**T. Haruyama (KEK)**

**Dec. 10, 1992**

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# TWO-PHASE CRYOGEN UNDER THE GROUND

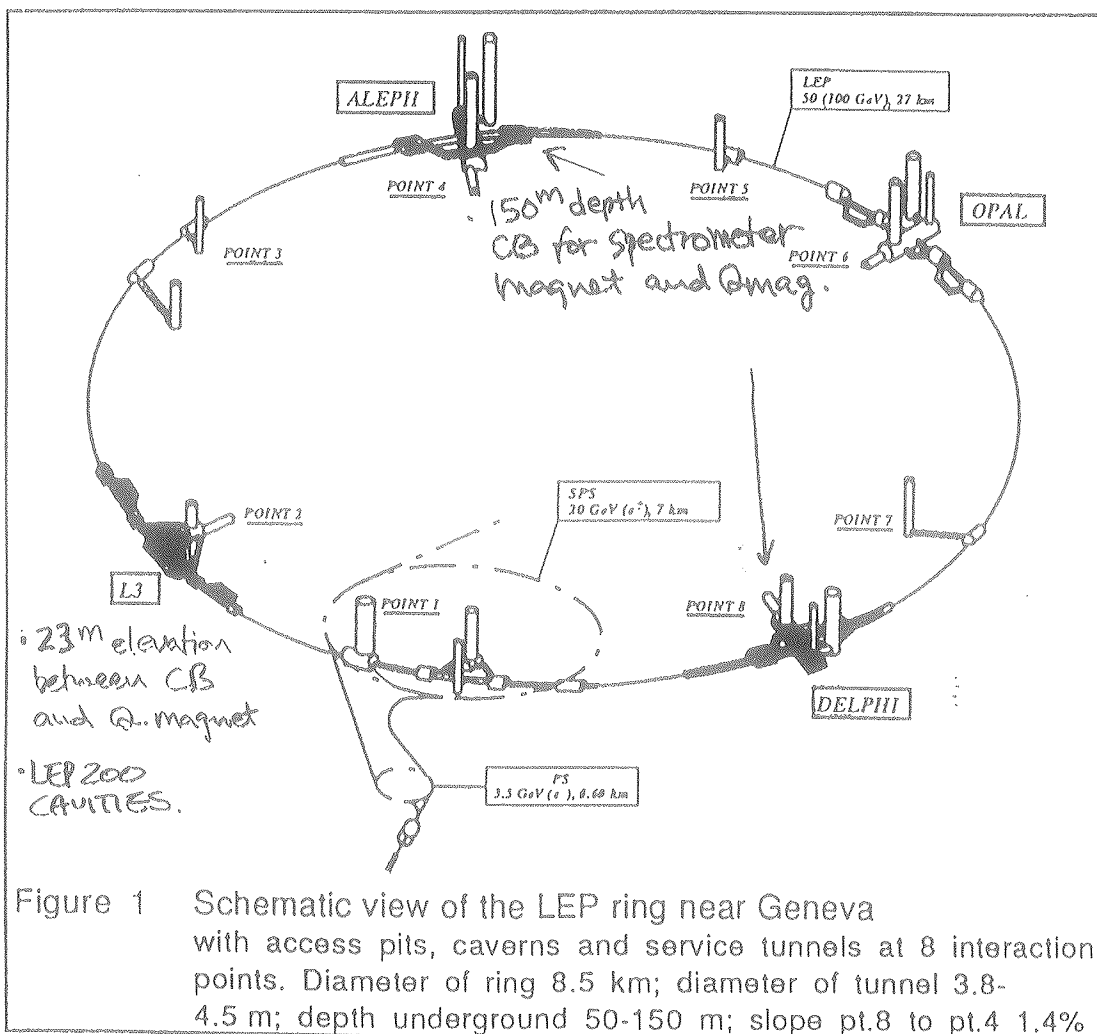
TOM HARUYAMA

KEK

PRESENTED AT SDC SUPERCONDUCTING MAGNET SUBGROUP MEETING IN  
JAPAN, DEC 8 -DEC11 1992

1. SOME RESULTS FROM EXPERIMENTS FOR CRYOGENIC  
FACILITY UNDER THE GROUND AT CERN

2. CONSIDERATION FOR SDC CRYOGENIC CONFIGURATION



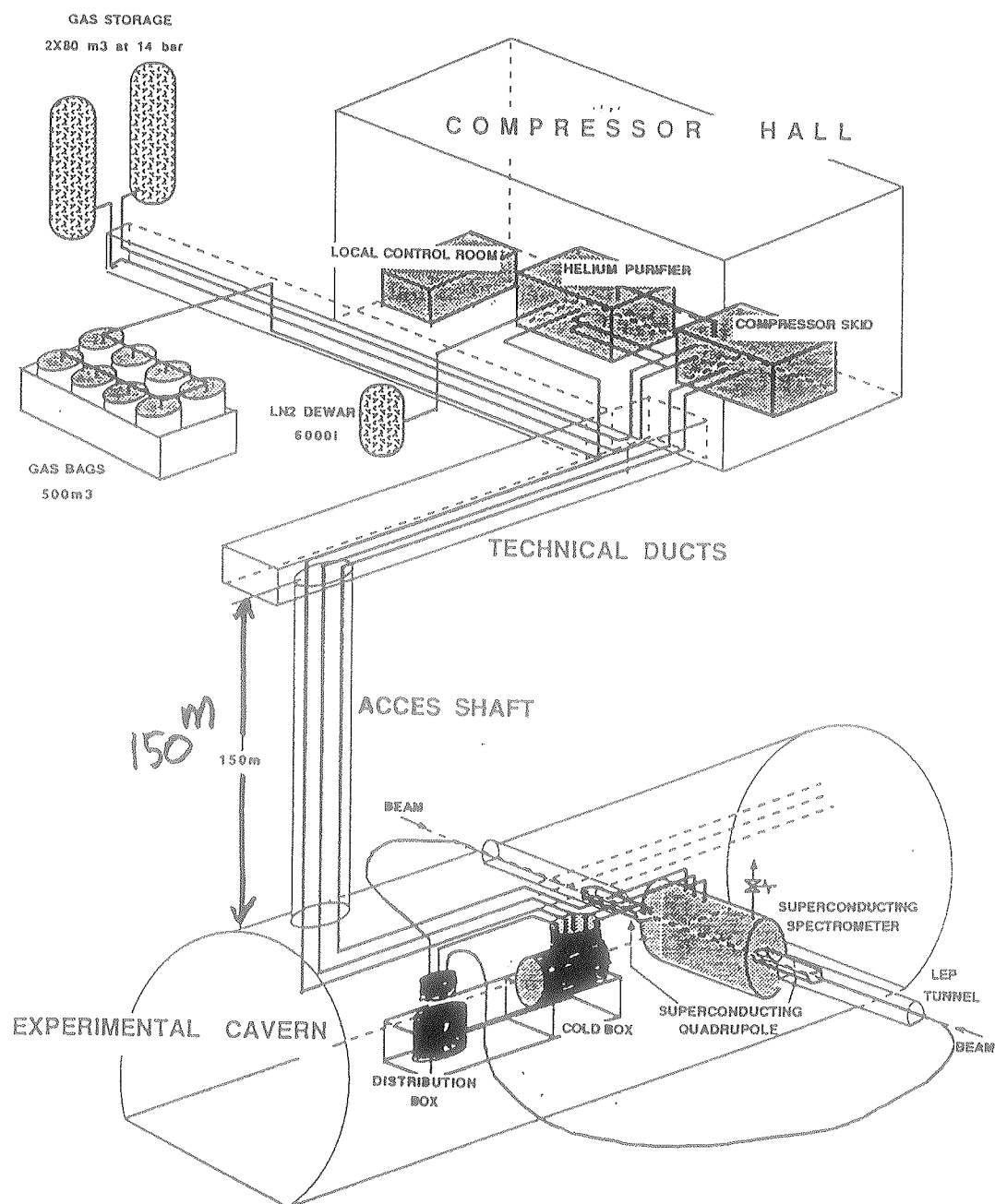


Fig. 3. Schematic layout of cryogenic equipment at a LEP experimental site.

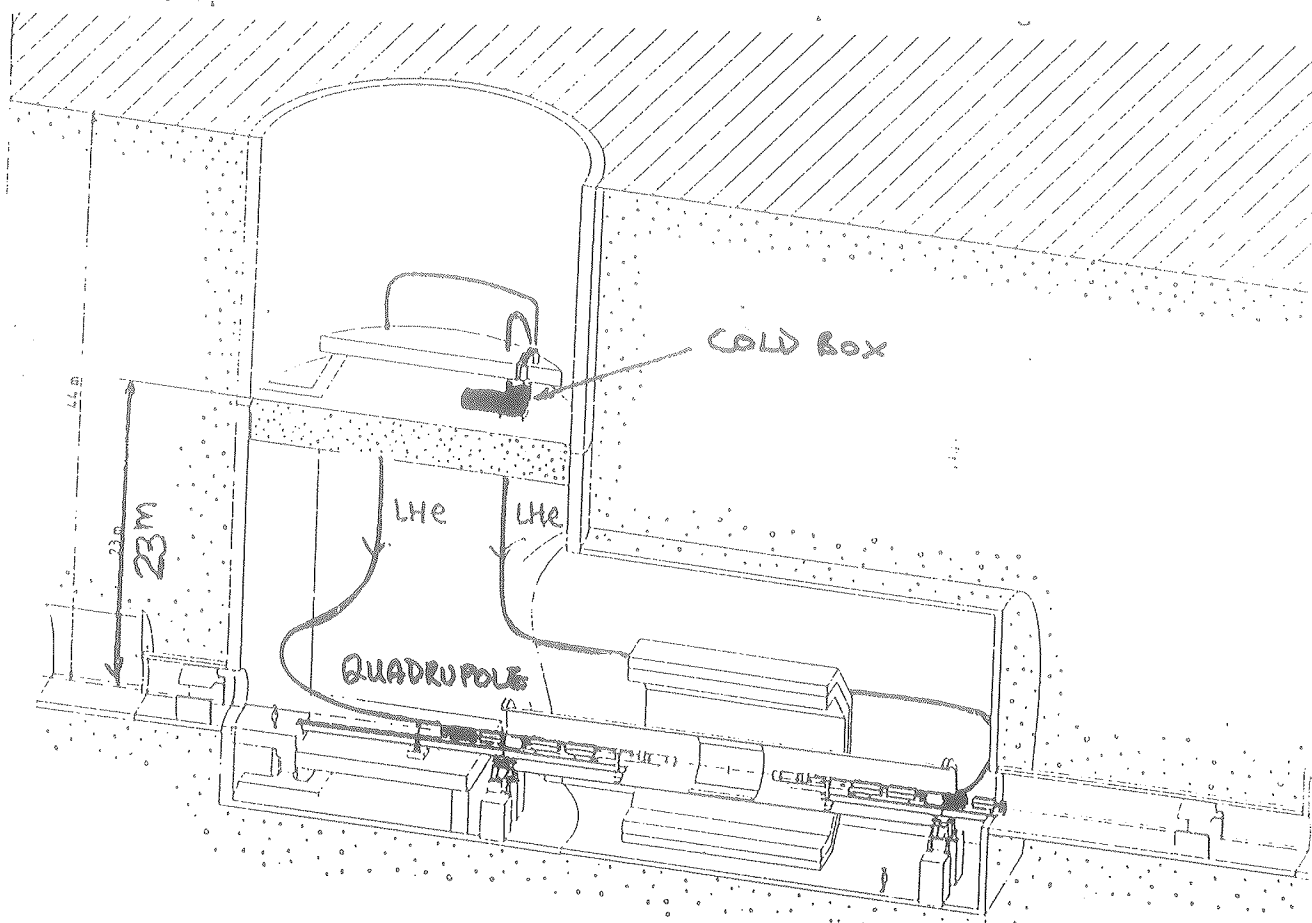


Fig. 3: Liquid helium transfer to superconducting quadrupole magnets  
at LEP experimental area No. 2

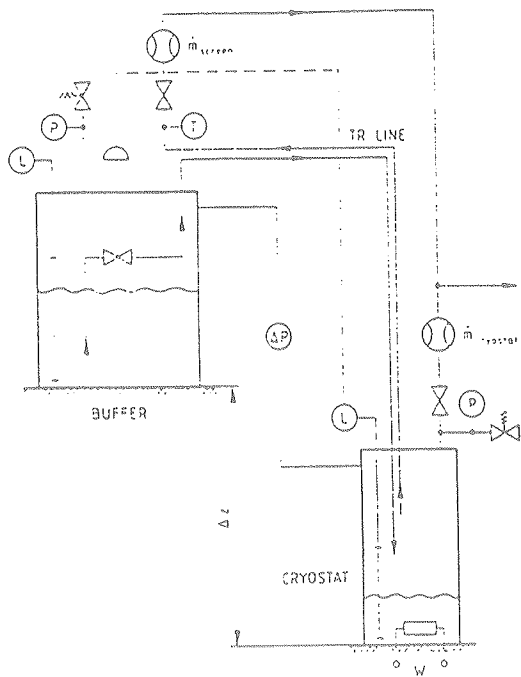


Fig. 1: Flow-scheme of transfer test set-up

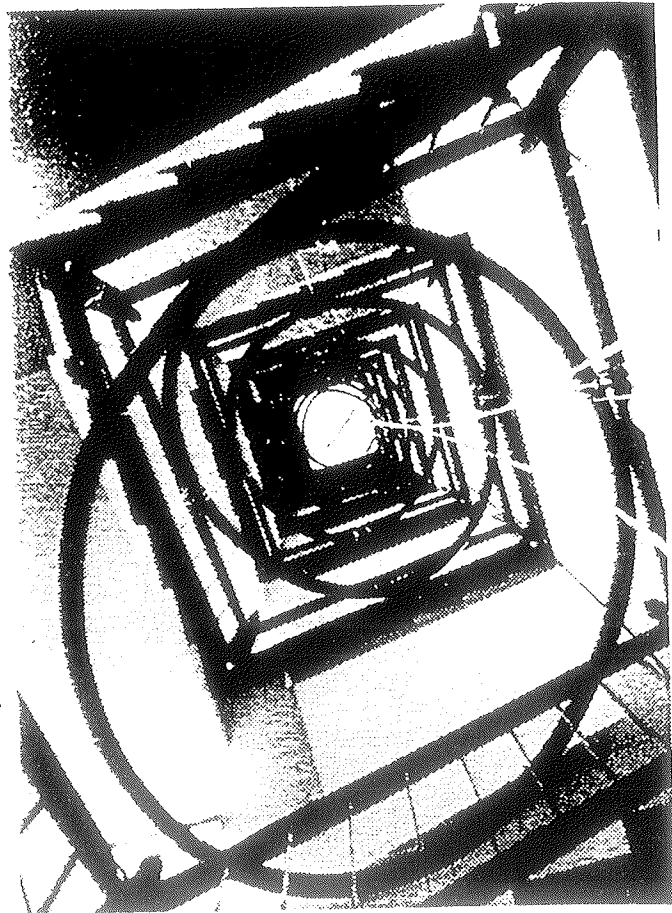
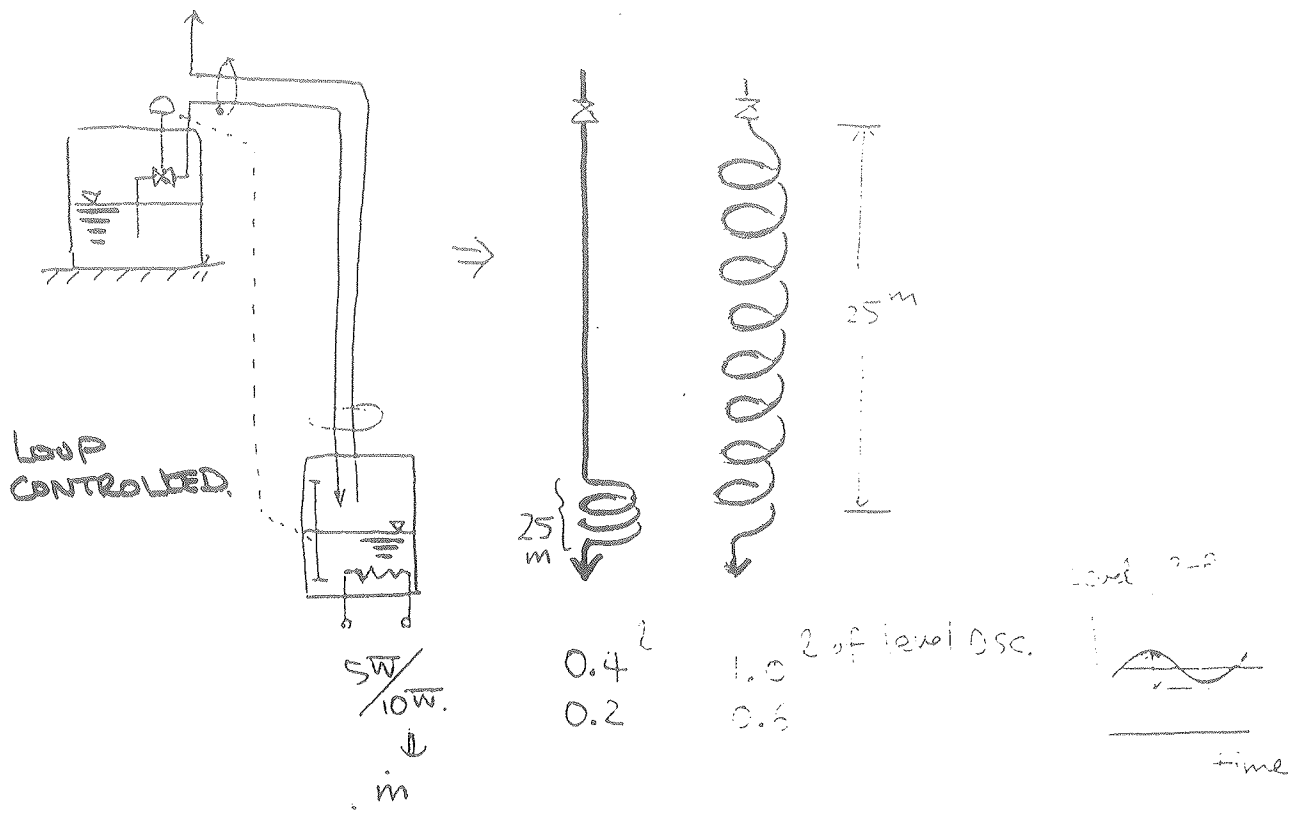


Fig. 2: Transfer line installed in helical pattern along staircase



LEP200 CAVITIES REQUIRE COOLING CAPACITY OF

12 kW @ 4.5K FOR 64 CAVITIES

18 kW @ 4.5K FOR 92 CAVITIES

\* THEY HAD DONE R&D EXPERIMENTS FOR THESE CONFIGURATIONS.

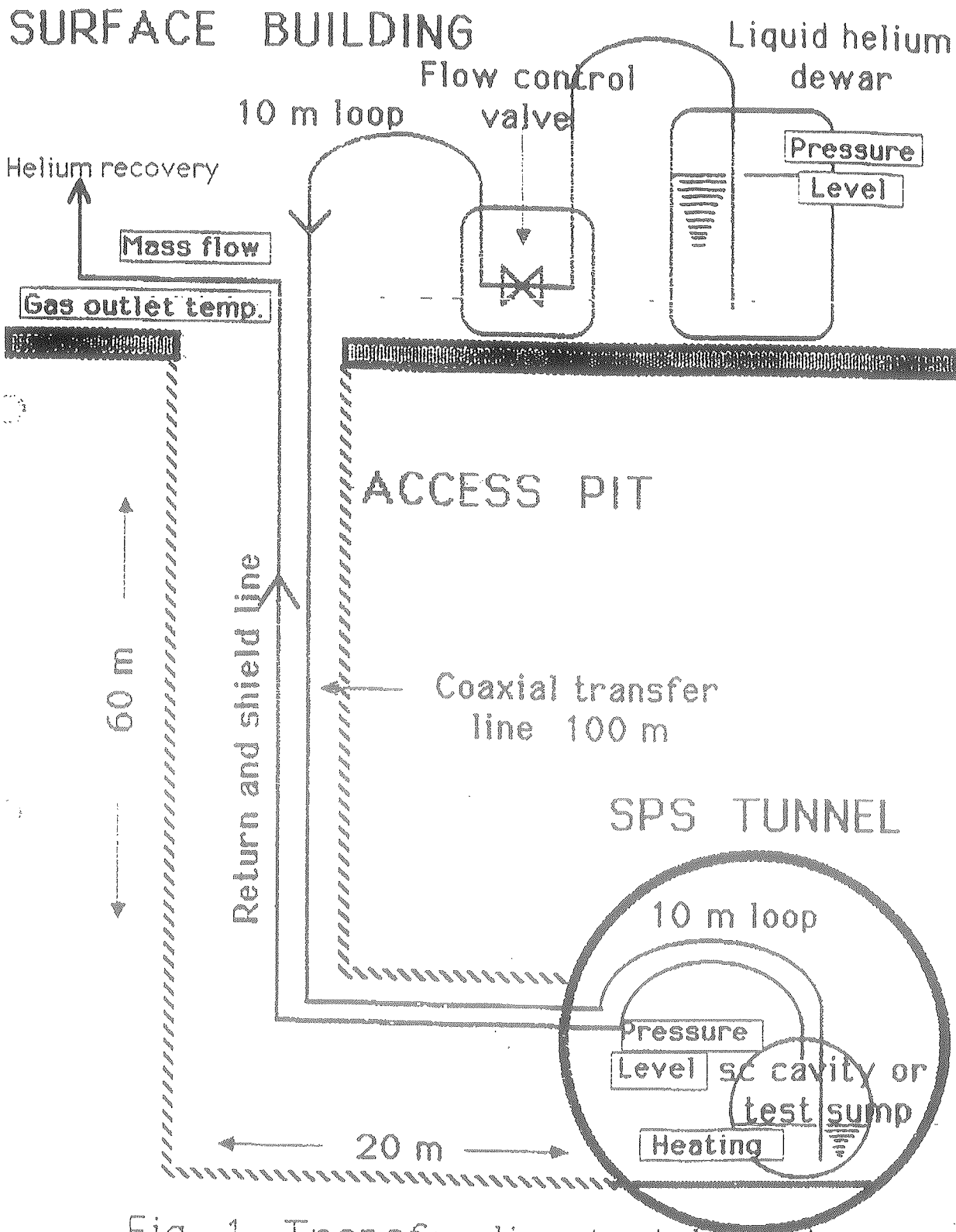
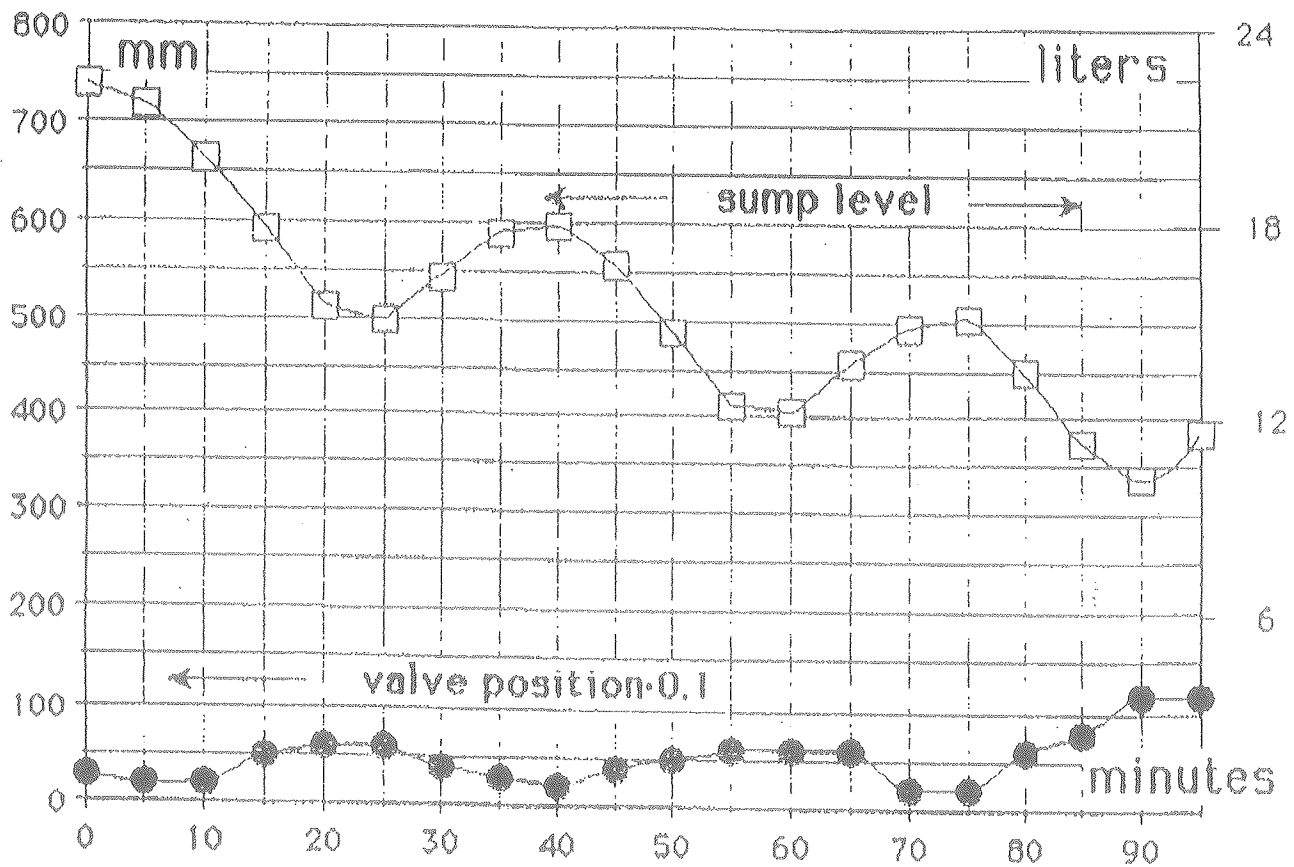


Fig. 1. Transfer line test layout



② 1.6  $\frac{g}{s}$   $\chi \approx 0.38$

Total mass flow gr/s	Heat inleak inner line Watt	Sump heating Watt	Gas outlet temperature K	Heat inleak return line Watt	Dewar pressure mbar	Sump pressure mbar	Flow quality at inner line outlet
0.9	15	3	91	400	1042	1025	0.83
1	12	8	77	380	1080	1030	0.6
1.5	13	19	56	400	1030	1045	0.41
1.5	14	18	55	400	1025	1062	0.43
1.6	13	21	52	400	1025	1065	0.38

Table 1. Results of the 100 m long transfer line tests

FLOW INSTABILITY DUE TO SYPHON EFFECT @ 2g/sec H  
WITH QUALITY  $x \approx 0.3$ , AND  $x=0.8$  FOR  $N_2$ .

VALVE WAS OUT OF CONTROL.

# FINAL CONFIGURATION FOR LEP 200 CAVITIES.

\* Tunnel. (Pilot).

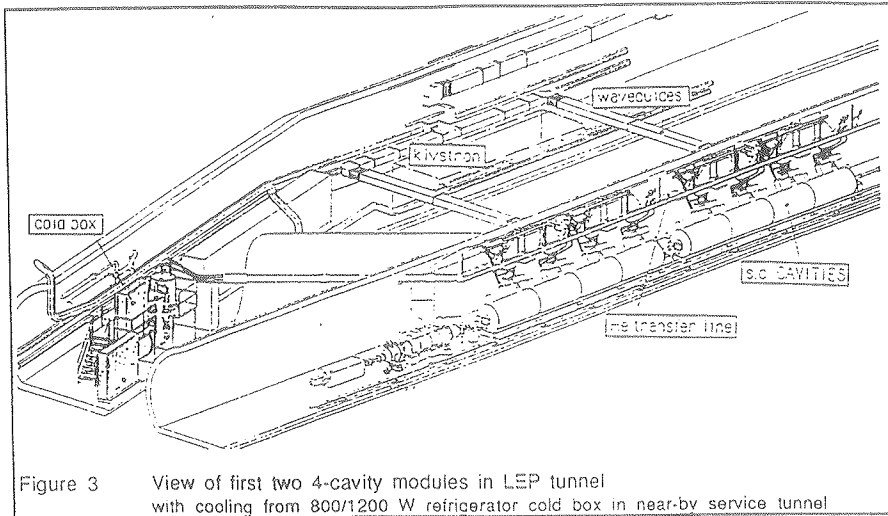
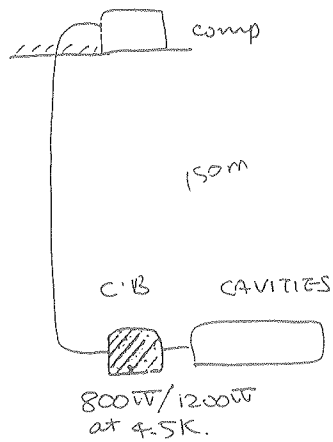


Figure 3 View of first two 4-cavity modules in LEP tunnel with cooling from 800/1200 W refrigerator cold box in near-by service tunnel

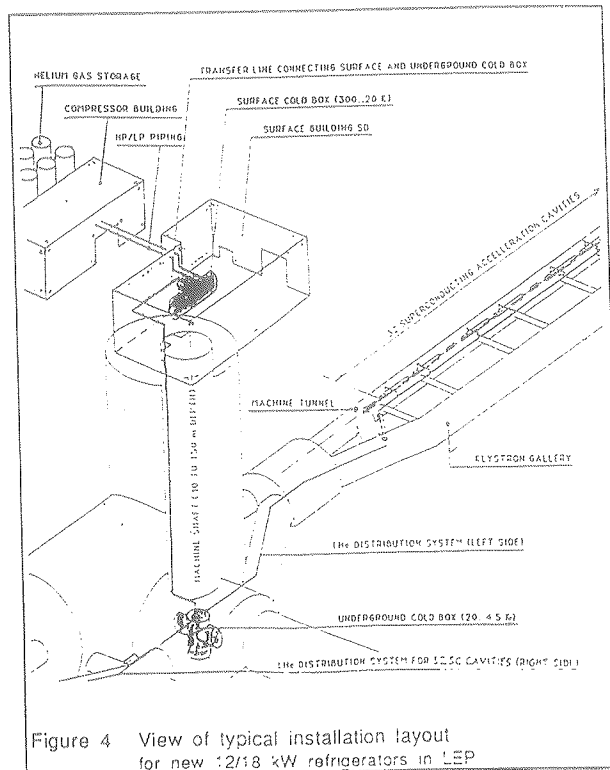
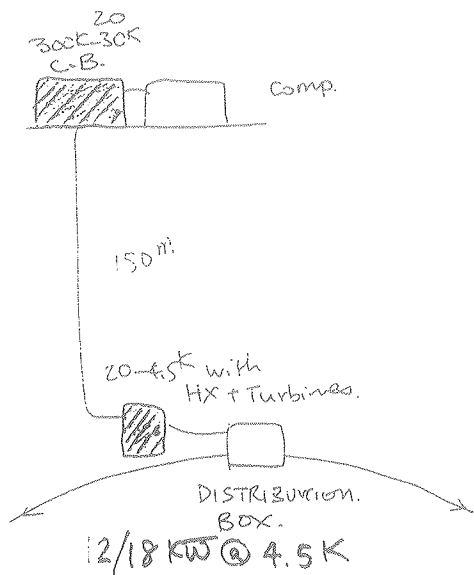
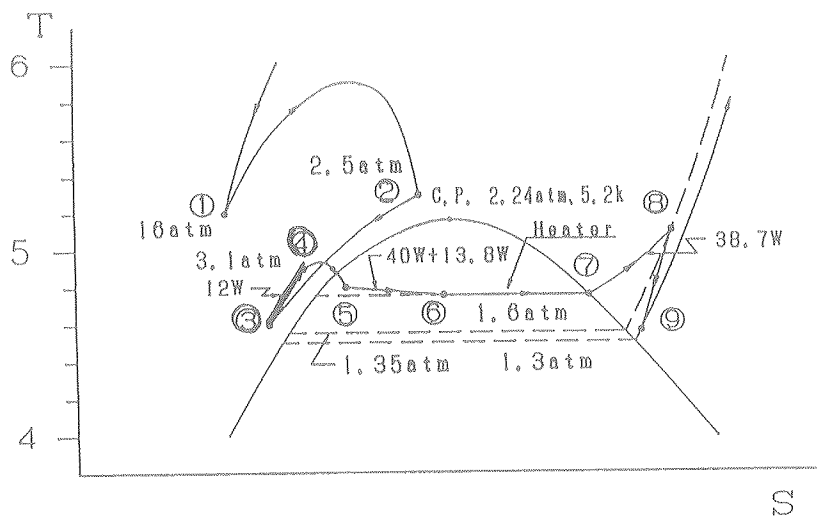
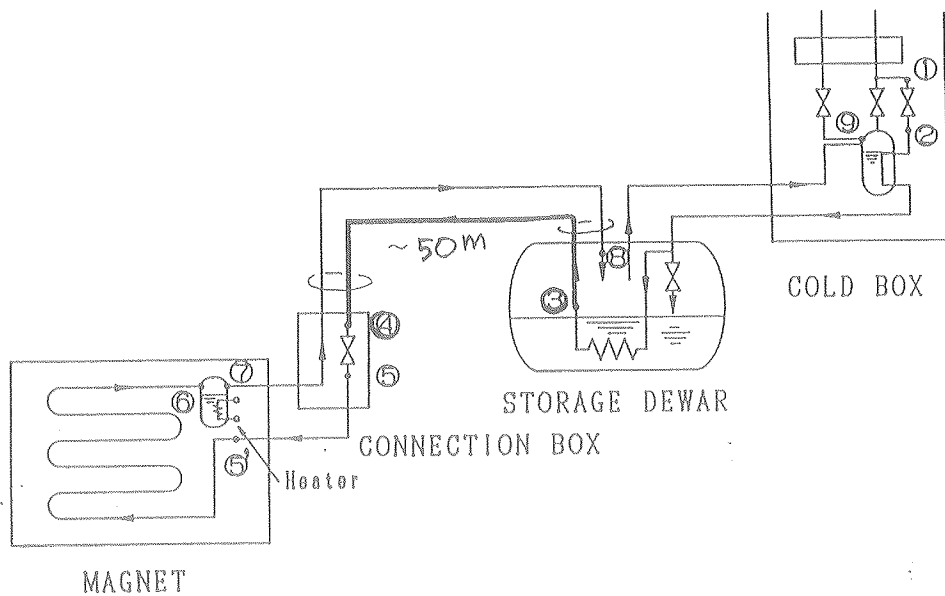


Figure 4 View of typical installation layout for new 12/18 kW refrigerators in LEP



PROJECT :

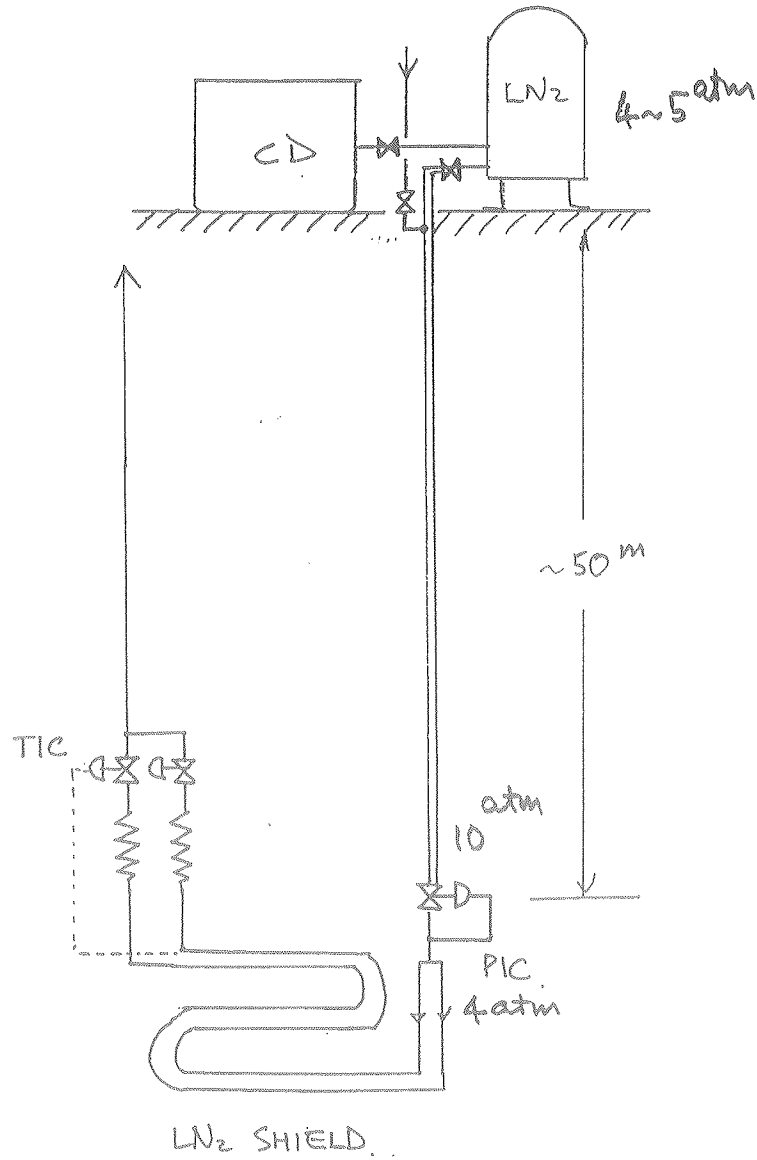
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SUBJECT :

NAME

DEPT.



DISTRIBUTION

## SUMMARY

He.....SUPERCRITICAL HELIUM MIGHT BEHAVE STABLE  
WITHOUT A KIND OF 2 PHASE FLOW INSTABILITY.

N<sub>2</sub>.....